


INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 63572A	FOR FURTHER ACTION		See Form PCT/PEA/416
International application No. PCT/US2004/043783	International filing date (day/month/year) 28.12.2004	Priority date (day/month/year) 06.01.2004	
International Patent Classification (IPC) or national classification and IPC B32B5/18, B32B27/32			
Applicant DOW GLOBAL TECHNOLOGIES INC.ET AL.			
<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 6 sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input checked="" type="checkbox"/> sent to the applicant and to the International Bureau a total of 11 sheets, as follows:</p> <p><input type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</p> <p><input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.</p> <p>b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p>			
<p>4. This report contains indications relating to the following items:</p> <p><input checked="" type="checkbox"/> Box No. I Basis of the opinion</p> <p><input type="checkbox"/> Box No. II Priority</p> <p><input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p><input type="checkbox"/> Box No. IV Lack of unity of invention</p> <p><input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p><input type="checkbox"/> Box No. VI Certain documents cited</p> <p><input type="checkbox"/> Box No. VII Certain defects in the international application</p> <p><input type="checkbox"/> Box No. VIII Certain observations on the international application</p>			
Date of submission of the demand 21.07.2005		Date of completion of this report 20.01.2006	
Name and mailing address of the international preliminary examining authority:  European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016		Authorized Officer De Jonge, S Telephone No. +31 70 340-2006	



**INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY**

International application No.
PCT/US2004/043783

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
 - ☐ publication of the international application (under Rule 12.4)
 - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

Description, Pages

1, 4-7, 9-20	as originally filed
2, 2a, 3, 3a, 8, 8a, 21	received on 21.07.2005

Claims, Numbers

1-24	received on 21.07.2005
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Drawings, Sheets

1/2, 2/2	as originally filed
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- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/figs
- ☐ the sequence listing (*specify*):
- ☐ any table(s) related to sequence listing (*specify*):

4. ☒ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages
- ☒ the claims, Nos. 11, 13, 20
- ☐ the drawings, sheets/figs
- ☐ the sequence listing (*specify*):
- ☐ any table(s) related to sequence listing (*specify*):

* If item 4 applies, some or all of these sheets may be marked "superseded."

**INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY**

International application No.
PCT/US2004/043783

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	12, 14 - 19
	No: Claims	1-10, 21 - 23
Inventive step (IS)	Yes: Claims	
	No: Claims	1 - 10, 12, 14 - 19, 21 - 23
Industrial applicability (IA)	Yes: Claims	1 - 10, 12, 14 - 19, 21 - 23
	No: Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Re Item I

Basis of the report

Claims 11, 13 and 20 now specify that the thickness of the foamed layer is seven to nine times the thickness of the at least one non-foamed polymer layer. The single example of figure 3 is not sufficient basis for this range of thicknesses. Hence, the requirements of Article 34(2)(b) PCT are violated.

Claims 11, 13 and 20 are not examined.

Re Item V

Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

The following document is mentioned in this report:

D1: EP-A-0 353 496

Novelty:

Document D1 discloses (cf. column 3, lines 26 - 32; claims 1, 6 - 8; figure 5b, column 6, lines 30 - 45) a flexible, creased material comprising a layer (18c) of a foamed propylene based material sandwiched between two outer layers (18a and 18b) made of a thermoplastic material selected from propylene-ethylene copolymer or propylene homopolymer. The three layers all have a thickness of 100 microns. The total thickness of the structure is 300 microns (= 0.3 millimetre).

The two outer layers comprise between 50 and 80 % (calculated on the total weight of the mixture; cf. column 6, line 9) of inorganic, particulate filler. Document D1 does not disclose the density of the foamed layer.

In the present invention the non-foamed layer comprises up to 50 % of particulate filler (cf. the present description, page 13, lines 17 - 22).

When comparing the specifically disclosed film of D1 comprising of 50 % of filler with the embodiment of the present invention also comprising 50 % of filler, then it is far more likely than not that the grammage of the film of D1 will fall within the presently claimed range of 100 - 500 g/m², whereby it is noted that similar materials are used for the various layers in D1 and in the present invention.

Furthermore, document D1 is silent with respect to the other parameters mentioned in present independent claim 1. However, since the products of D1 and of the present application are the same in all other aspects, and *since the uses are the same and since the problems of D1 and of the present application are similar*, it follows that the product of D1 must inevitably also meet these other parametric requirements.

Hence, it appears that the subject-matter of independent claim 1 is not novel in view of D1; Article 33(2) PCT. The subject-matter of dependent claims 2 - 10 and 21 - 23 is also not novel.

The subject-matter of dependent claims 12, 14 - 19 differs from the subject-matter of D1 in that according to D1 the non-foamed layer contains at least 50 % of filler, whereas according to present claim 12 the amount is maximum 40 % of filler, and according to claims 14 - 19 the layer contains no filler. The subject-matter of claims 12 and 14 - 19 is thus novel in view of D1; Article 33(2) PCT.

Inventive Step:

Since the subject-matter of claims 1 - 10 and 21 - 23 is not novel, it is also not considered inventive; Article 33(3) PCT.

In the absence of comparative data, the only problem underlying claims 12 and 14 - 19 seems to be the provision of an alternative multilayered film. Since fillers are usually only present to make plastic films cheaper, the skilled person would immediately realize that the weight content of the filler may be changed without substantially changing the properties of the film. Hence, the subject-matter of claims 12 and 14 - 19 cannot be considered inventive; Article 33(3) PCT.

Industrial Applicability:

The subject-matter of independent claim 1 and its dependent claims is considered to meet the requirements of Article 33(4) PCT.

Re Item VII

Certain defects in the international application

- 1) Document D1 has not been identified in the description and the relevant background art disclosed therein has not been briefly summarised in an objective way. The requirements of Rule 5.1(a)(ii) PCT are violated.
- 2) The independent claim 1 has not been cast in the two part form, with those features which in combination are part of the prior art (see document D1) being placed in the preamble. Hence, the requirements of Rule 6.3(b) PCT are violated.

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wherein T is the total thickness of the multilayer sheet measured according to the American Society of Standards and Materials (ASTM) standard ASTM D645M-97 expressed in millimetres; and

$$100 < G < 500 \quad (1b)$$

wherein G is the grammage of the multilayer sheet determined according to ASTM D646-96 (re-approved 2001) expressed in grams per square metre (g/m²) ; and

$$S \geq 2 \times 10^{-7} G^{3.1872} \quad (1c)$$

wherein S is the geometric mean bending moment of the multilayer sheet expressed in milliNewton metres (mN m) calculated from the following relationship:

$$S = (S_m S_c)^{0.5} \quad (1d)$$

wherein S_m is the maximum bending moment in the plane of the multilayer sheet expressed in milliNewton metres (mN m) and determined according to the two-point method described in the Deutsches Institut für Normung e.V. (DIN) standard DIN 53121 : 1996-12 and S_c is the bending moment measured perpendicularly to the direction selected for the determination of S_m in the plane of the multilayer sheet expressed in milliNewton metres (mN m) and determined according to the two-point method described in DIN 53121 : 1996-12.

Figure 1 represents a schematic diagram of apparatus used to produce crease mark.

Figure 2 is a schematic illustration of a packaging article comprising a cut and creased multilayer sheet.

Figure 3 represents a photograph illustrating the cross section through a multilayer sheet, containing an inner foamed layer and two outer non-foamed layers. The thickness of each of the outer layers is 75 micrometers and 87 micrometers (794 µm -707 µm), respectively. The thickness of the foamed layer is 632 micrometers (707 µm -75 µm).

The multilayer sheet of the present invention is particularly suitable for shaping by cutting, scoring or creasing on a carton board conversion machine such as an Autoplaten® SP Evoline 102E plus (supplied by Bobst S.A., Switzerland), and for thermoforming into complex shapes.

The total thickness of the multilayer sheet of the present invention satisfies the following relationship:

$$0.2 < T < 2 \quad (1a)$$

wherein T is the total thickness of the multilayer sheet measured according to ASTM D645-97 expressed in millimetres (mm). The minimum thickness of the sheet should not be less than 0.2 mm to avoid technical difficulties when the multilayer sheet is used in place of carton board in carton board conversion machines such as the Autoplaten® SP Evoline 102E plus. An example of a technical difficulty which may occur if the multilayer sheet is too thin is that the sheet may deform when the sheet is fed to the carton board conversion machine causing blockage of the machine. The maximum thickness of the multilayer sheet is not critical for the practice of the invention but for reasons of economy should not be greater than 2 mm. In a preferred embodiment of the invention the thickness of the sheet T is from 0.3 to 1.5 mm, more preferably from 0.5 to 1.5 mm, which provides the best compromise between structural stability requirements of the sheets and articles and the cost of manufacture of the sheet and the articles.

Another important parameter of the multilayer sheet of the present invention is the grammage G of the multilayer sheet determined according to ASTM D646-96 (re approved 2001) expressed in grams per square metre (g/m²). The grammage G of the multilayer sheet satisfies the following relationship:

$$100 < G < 500 \quad (1b) .$$

The range of grammage G given in equation (1b) provides a good compromise between structural stability requirements of the sheet and articles manufactured therefrom and the cost of manufacture of the sheet and the articles.

In a preferred embodiment the grammage is greater than or equal to 200 grams per square metre, and in a more preferred embodiment the grammage is greater than or equal to 240 grams per square metre. In yet another preferred embodiment the grammage is less than or

equal to 450 grams per square metre, and in a more preferred embodiment the grammage is less than, or equal to, 410 grams per square metre.

metre per 24 hours (cm^3/m^2 24h) and are determined according ASTM D-3985 at ambient temperature and pressure and is typically less than $6000 \text{ cm}^3/\text{m}^2$ 24h.

The multilayer sheet of the present invention comprises a foamed polymer layer wherein the foamed polymer layer is produced from a foamable polymer composition comprising units derived from propylene. Useful foamable polymer compositions and foams for producing the foamed propylene polymer layer are taught in US patent Nos. 6,544,450; 6,440,241; 6,417,242; 6,417,240, and 6,251,319.

The term "foamable propylene polymer composition" as used herein means a composition which comprises a polymer in which at least 50 weight percent of its monomeric units are derived directly from propylene and which is used to make the foamed layer of the multilayer sheet of the present invention.

As used herein, the term "propylene homopolymers" means polymers derived from the reaction of propylene monomer, whereas the term "propylene interpolymers" means polymers derived from the reaction of propylene monomer and at least one monomer other than propylene and includes, for example, random, block, and grafted copolymers and terpolymers.

The polymer of the foamable propylene polymer composition may be comprised solely of one or more propylene homopolymers, one or more propylene interpolymers, blends of one or more of each of propylene homopolymers and propylene interpolymers, and blends of the previously mentioned propylene polymers with polymers which do not comprise propylene. The propylene polymer of the foamable propylene polymer composition comprises at least about 50, more preferably at least about 80, and most preferably about 100, weight percent propylene monomer derived units based upon the total weight of the polymer in the foamable propylene polymer composition.

Appropriate propylene interpolymers include interpolymers of propylene and an alkene selected from the group consisting of ethylene, 1-alkenes having from 1 to 10 carbon atoms, and dienes having from 4 to 10 carbon atoms. Propylene interpolymers also include random terpolymers of propylene and 1-alkenes selected from the group consisting of ethylene and

1- alkene monomers having 4 to 10 carbon atoms. The 1-alkenes having 4 to 10 carbon atoms include the linear and branched alkenes such as, for example, 1-butene, isobutylene,

The multilayer sheet is formed by extrusion laminating a layer of the cast film to each side of the foamed layer using Adflex™ X 100 G Thermoplastic Polyolefin Elastomer (available from Basell Polyolefins N.V., The Netherlands) applying 40 grams per square metre of the Adflex™ X 100 G Thermoplastic Polyolefin Elastomer to each surface of the foamed layer.

Example 4

The multilayer sheet of example 4 is produced by essentially the same method as described in example 3 except that the foamed layer selected has a higher thickness and density than in example 3. The grammage of the multilayer sheet thus produced is 400 grams per square metre.

Example 5

The multilayer sheet of example 5 is produced by the same method as described in example 3 except that the non-foamed layers are cast film made from H302-09RSB polypropylene (available from the Dow Chemical Company) and 30 weight-percent Polybatch™ RTP 1097 filler concentrate (available from A.Schulman, Inc). The Polybatch™ RTP 1097 filler concentrate contains 70 percent filler. Thus, the filler loading in the polypropylene resin is 21 weight-percent.

Example 6

The multilayer sheet of example 6 is produced by the same method as described in example 5 except that the thickness and density of the foamed layer are increased. The total thickness of the multilayer sheet thus produced is 1.14 millimetres and the grammage of the multilayer sheet thus produced is 400 grams per square metre.

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EPO - DG 1

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(91)

WHAT IS CLAIMED IS:

1. A multilayer sheet comprising at least one foamed propylene polymer layer and at least one non-foamed polymer layer, and wherein the non-foamed polymer layer comprises a polymer, comprising units derived from an 1-alkene monomer, and

wherein the multilayer sheet has properties which satisfy the following relationships:

$$0.2 < T < 2 \quad (1a),$$

wherein T is the total thickness of the multilayer sheet, measured according to ASTM D645-97, and expressed in millimetres; and

$$100 < G < 500 \quad (1b),$$

wherein G is the grammage of the multilayer sheet determined according to ASTM D646-96, and expressed in grams per square metre; and

$$S \geq 2 \times 10^{-7} G^{3.1872} \quad (1c),$$

wherein S is the geometric mean bending moment of the multilayer sheet, expressed in milliNewton metres, and calculated from the following relationship:

$$S = (S_m S_c)^{0.5} \quad (1d),$$

wherein S_m is the maximum bending moment in the plane of the multilayer sheet, expressed in milliNewton metres, and determined according to the two-point method described in DIN 53121 : 1996-12, and S_c is the bending moment measured perpendicularly to the direction of S_m in the plane of the multilayer sheet, and expressed in milliNewton metres, and determined according to the two-point method described in DIN 53121 : 1996 -12.

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2. The multilayer sheet of claim 1, wherein the geometric mean bending moment of the multilayer sheet, S , satisfies the following relationship:

$$S \geq 0.0021 G^{1.7573} \quad (2).$$

3. The multilayer sheet according to claim 1, wherein the multilayer sheet comprises a crease.
4. The multilayer sheet of claim 3, wherein the average bending force, F , which is required to maintain the angle of the crease at 90 degrees, is less than 3 Newton.
5. The multilayer sheet according to any of the claims 1-4, wherein the multilayer sheet has a maximum sheet curl, C , of less than 20 millimetres.
6. The multilayer sheet according to any of the claims 1-5, wherein the non-foamed polymer layer comprises a polymer, comprising units derived from propylene.
7. The multilayer sheet according to any of the claims 1-6, wherein the multilayer sheet is thermoformable.
8. An article comprising the multilayer sheet of any of the claims 1-7.
9. The article of claim 8, wherein the article is a packaging article.
10. The article of claims 8 or 9, wherein the article comprises at least one crease or score mark.
11. The multilayered sheet according to claims 1-10, wherein the thickness of the at least one foamed propylene polymer layer is seven to nine times the thickness of the at least one non-foamed polymer layer.
12. The multilayer sheet of claim 1, wherein the at least one non-foamed polymer is a filled layer, prepared from a polymer composition comprising up to 40 weight percent of a filler, based on the total weight of the composition.

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13. The multilayered sheet according to claim 12, wherein the thickness of the at least one foamed propylene polymer layer is seven to nine times the thickness of the filled, non-foamed polymer layer.

14. The multilayered sheet of claim 1, wherein the at least one non-foamed polymer layer is an unfilled layer.

15. The multilayer sheet of claim 14, wherein the geometric mean bending moment of the multilayer sheet, S, satisfies the following relationship:

$$S \geq 0.0021 G^{1.7573} \quad (2).$$

16. The multilayer sheet according to claim 14, wherein the multilayer sheet comprises a crease.

17. The multilayer sheet of claim 16, wherein the average bending force, F, which is required to maintain the angle of the crease at 90 degrees, is less than 3 Newton.

18. The multilayer sheet according to any of the claims 14-17, wherein the multilayer sheet has a maximum sheet curl, C, of less than 20 millimetres.

19. The multilayer sheet according to any of the claims 14-18, wherein the non-foamed polymer layer comprises a polymer, comprising units derived from propylene.

20. The multilayered sheet according to claims 14-19, wherein the thickness of the at least one foamed propylene polymer layer is seven to nine times the thickness of the at least one non-foamed polymer layer.

21. The multilayer sheet according to any of the claims 11-20, wherein the multilayer sheet is thermoformable.

22. An article comprising the multilayer sheet of any of the claims 11-21.

23. The article of claim 22, wherein the article is a packaging article.

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24. The article of claims 22 or 23, wherein the article comprises at least one crease or score mark.

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